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FUTURE INDICATORS OF NAVY PERFORMANCE: AN EXTENSION OF CURRENT --ETC(U)

JUL 78 D G BOWERS, J L FRANKLIN

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REPORT VI.

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INTRODUCTION

Previous reports in the present series have described the methods and concepts, and then examined empirical relationships required, for a system of future performance trend indicators. Equations for each of a number of performance periods were generated, and value attribution procedures were used to estimate the present value of predicted performance changes.

In all of these previous reports, extant civilian data from the Survey of Organizations data bank were combined to form a hypothetical composite organization. In the present instance, our attention turns to the extent to which the relationships obtained and the requirements met with the civilian data set are replicated in Navy data. These Navy data had been for an earlier study from the Navy Human Resource Management Survey (HRMS) data bank and from an extensive management information system maintained by the Navy. (Drexler & Franklin, 1976; Franklin & Drexler, 1976)

The civilian example developed and analyzed in the previous reports of this series established rather conclusively the following:

- . There was evidence of both concurrent and predictive relationships of the Survey of Organizations' predictors to the criteria (total variable expense, TVE, & absenteeism rate, ABS).
- . As the theory underlying current value human resources accounting would predict, the relationships with future performance periods (i.e., predictive relationships) were stronger than those with concurrent performance periods. The former reached mean multiple R values of approximately .50, while the latter attained an average peak of slightly above .30. Similar patterns were displayed by both criterion measures, TVE, and ABS.

- . A tentative conclusion was reached that the lag time period (from measured organizational functioning to the peak of its impact) was nine to 18 months. Consideration of the time from the likely onset of organizational practices to this same subsequent peak could extend the total cycle time to nearly two years.
- . Value attribution procedures, together with capitalization and discounting, indicated that even small changes in the human organization could yield significant increments or decrements in future performance.
- . Although a number of difficult questions remain, the findings clearly demonstrated that a current value system of human resources accounting is feasible.

While those findings demonstrate the feasibility of a system of future performance trend indicators in the civilian sector, the basis for their direct extension to the Navy must be laid. Specifically, the first four of the six original assumptions (Pecorella & Bowers, 1976) must be re-examined with the Navy, its functioning, and the performance of its units in mind:

- (1) There must be available scientific evidence which identifies key dimensions of Navy organizations.
- (2) There must be adequate methodology and instruments for measuring these key dimensions.
- (3) There must be reliable and valid Navy performance data.
- (4) There must be available knowledge of the relationships between key dimensions of Navy organizations and performance outcomes.

Taking the first of these questions, there has accumulated a significant volume of evidence extending the key dimensions found in the Survey of Organizations, and used in the civilian analyses earlier in this present project, to Navy settings. The first of these came from a complex project supported by the Manpower R&D Program of the Office of Naval Research. Summarized in Report IV (Bowers, 1975), the findings indicated the following:

- (1) Far from being unlike civilian organizations in form and functioning, Navy units display the same sorts of relationships and properties as their civilian counterparts.
- (2) Differences between preferences and experiences in Navy units are very similar to those present in civilian organizations.
- (3) Constructs measured for Navy units display patterns of relationships quite comparable to those obtained in civilian organizations.
- (4) Types of groups encountered in Navy units are similar to those encountered in civilian organizations.
- (5) Satisfaction and motivation of persons in Navy units relate to the same sorts of practices and interpersonal conditions found to yield them in civilian organizations.

In short, this first project demonstrated strong parallels between what was associated with effectiveness of civilian organizations and what related to effectiveness of Navy units. It suggested that the key dimensions of Navy human organizations are very similar to the key dimensions of civilian organizations.

This has been largely confirmed in subsequent research. Beginning in August, 1973, representatives of the Navy's then budding Human Resources Management Program met with persons from ISR to modify the Survey of Organizations for Navy use. Some SOO indexes or dimensions were reworded slightly or retitled to make them more compatible with Navy customs (e.g., "Organizational Climate" became "Command Climate"). A small number of additional measures were added, particularly in the social concerns area of equal opportunity and drug/alcohol abuse and in the area of military discipline.

Between December, 1973, and March, 1975, this Navy instrument -- entitled the Human Resource Management Survey (HRMS) went through eight revisions. These forms were basically similar, but included additions of new items,

deletions of some items, and minor modifications. Drexler subsequently used an accumulation of approximately 65,000 HRMS cases to analyze the internal structure of the survey (Drexler, 1974). Using smallest space analysis (Guttman, 1968), he identified the following areas and indexes as contained in the HRMS:

<u>CONCEPTUAL AREA</u>	<u>INDEXES</u>
Supervisory Leadership	Support Team Building Goal Emphasis Work Facilitation
Work Group (Peer) Behavior	Peer Support Peer Work Facilitation Peer Problem Solving Peer Team Work
Work Group Emergents	Group Processes Group Readiness Group Discipline
Command Climate	Human Resource Emphasis Motivational Conditions Decision Making Practices Communication Flow
Content Dimensions	Career Counseling Equal Opportunity Supervisor's Responsiveness to Drug Abuse Supervisor's Responsiveness to Alcohol Abuse Transition
Outcome Dimensions	Overall Satisfaction Satisfaction with Progress Work Affect Integration of Men and Mission

Thus the structure of the common or "core" content of the HRMS appeared from Drexler's analysis to be nearly identical to that of the SOU. Wilcove (1976) used factor analysis in a repeat investigation and obtained findings similar to Drexler's. In both of these studies, analyses were conducted within areas having a common referent, thus eliminating the tendency for factors to emerge largely by referent alone. Sachar (1976), in a separate study, also used factor analysis in separate analyses of the sea and shore versions of the HRMS. In this instance, analyses were done in the aggregate, rather than by referent area, to assess internal structure of the survey. Her analyses confirmed what has been found elsewhere, that major "blocks" of common-referent content exist. By way of summary of evidence concerning the first two assumptions, there appears to be adequate grounds for feeling that the key dimensions of functioning of Navy organizations are substantially the same as those of civilian organizations, and that the HRMS as an instrument provides a method analogous to that of the SOU for assessing those dimensions.

The third and fourth assumptions -- availability of performance measures and knowledge of the relationships of key dimensions to them -- involve a somewhat wider array of evidence. At the outset, it is useful to recall the earlier work by Dunnette and his colleagues, cited in the first report in the series. (Dunnette, Milkovich, & Motowidlo, 1973; Borman & Dunnette, 1974). They identified the requirements for a Navy personnel status index using results from a policy-capturing procedure which were subsequently factor analyzed. These investigators identified three essential domains of Navy outcome indicators: retention rate, readiness, and discipline.

Within the last five years there has accumulated an impressive array of evidence indicating that key HRMS indicators (or in at least two instances their S00 equivalents) relate predictably to outcomes in each of these domains. For example, Crawford & Thomas (1976) found HRMS measures to be significantly correlated with non-judicial punishment rates aboard Navy ships. In the area of retention rate, Drexler and Bowers (1973) found significant correlations to actual reenlistment rates of 22 Navy units. Bowers (1973) validated a measure of reenlistment intention and found that five factors from the S00 were strongly related to that intention. Franklin & Drexler (1976) found significant relationships of HRMS indicators to reenlistment rate aboard nearly 100 Navy ships. Finally, Shields and Walls (1978) cite an unpublished briefing in which HRMS indexes were related to retention rate aboard submarines.

In the readiness area, several studies have also indicated significant and directionally appropriate relationships. Mumford (1976) found significant relationships of HRMS indexes to performance of Navy ships in refresher training exercises. Shields and Walls (1978) found relationships of HRMS indexes to maintenance proficiency of aviation squadrons and (in the same unpublished briefing cited earlier) to submarine propulsion safeguard examination evaluations. Siegried and West (1977) found HRMS scores to be related to safety performance in fighter aircraft squadrons. Finally, Franklin and Drexler (1976) found consistent and frequently significant relationships of HRMS indexes to FORSTAT measures of operational readiness.

Thus the weight of evidence strongly suggests that (a) performance domains for Navy units can be identified, (b) some measures of acceptable quality exist in these domains, and (c) HRMS indexes relate to these performance measures in ways quite similar to their S00/civilian counterparts.

The four main assumptions would therefore appear to be adequately satisfied to begin the transition from civilian to Navy applications. An important addendum lies in the fact that Franklin and Drexler (1976) found a two-peak pattern of concurrent and predictive relationships almost identical to that obtained in this present study for civilian data. However, all coefficients presented in the Franklin and Drexler report were zero-order; no multivariate predictions were undertaken for that study.

In the present instance, therefore, it seemed useful to reanalyze the Franklin and Drexler data set using multiple regression techniques. Because the case count of organizational units is small compared to those in the present study's civilian data set, the cross-validation procedure could not be undertaken. Still, the findings may be taken with some caution as suggestive, provided they appear to replicate those in the civilian sector.

Data and Methods

Measures of organizational functioning in the Franklin and Drexler data set were obtained from the HRMS data bank which, at that time, contained the responses of approximately 65,000 Navy personnel. Reenlistment data were obtained from the Bureau of Naval Personnel for nearly 300 units. Five types of operational readiness data were also obtained for roughly 100 units. Both the reenlistment and operational readiness data were standardized and relativized to remove extraneous, severe variation across time, plus seasonal fluctuations. Readiness data were aggregated from daily ratings to one-month averages for six-months prior to, and six-months subsequent to, the time (T_0) of survey administration. Reenlistment data, on the other hand, were aggregated into four-month periods where T_0 = the reenlistment rate for the month of the survey plus the three subsequent months.

The readiness measures consisted of ratings in five areas:

Personnel Readiness (P) - rating of actual personnel strength versus structured strength.

Equipment and Supplies on Hand (S) - rating of essential equipment on hand versus that allowed for a unit.

Equipment Readiness (E) - rating of availability and condition of mission-essential equipment.

Training (T) - rating of unit's ability to perform against standards set for a unit of its type.

Overall Readiness (R) - summary of above ratings plus the unit's performance re: stand down, morale, actual qualifications of individuals, and environment.

Two reenlistment measures were used, representing periods within the July 1974 - June 1975 time frame:

Total Reenlistment - the ratio of the number of persons in the unit reenlisting to the total number in the unit eligible to reenlist.

First-Term Reenlistment - the ratio of the number of first-term persons in the unit reenlisting to the total number of first-term persons eligible to reenlist.

For each of the two kinds of criteria (readiness & reenlistment rate) a decision was made to standardize performance scores within the unit and then relativize in terms of time prior to and after survey measurement. As such, these procedures were the same as those used in the civilian analyses of the present project.

The statistical technique employed in the analyses was that of linear multiple regression, using the MIDAS software system of the University of Michigan Computing Center. (Fox & Guire, 1976)

Results

Table 1 presents multiple regression results, predicting each of the five Readiness measures by time period from (a) Command Climate indexes, (b) Supervisory Leadership indexes, (c) Peer Leadership indexes, and (d) the four dimensions, i.e., the mean of each of the three areas above (a to c) plus the group coordination index. Several facts appear to be obvious from these findings:

- . There are roughly twice as many significant coefficients in the total table as one would expect by chance alone.
- . If we split the table into time frames -6 through 0 (near past/contemporary) and +1 through +6 (immediate future), we find that there are three or four times as many significant coefficients in the later time frame as in the earlier time frame.
- . This mass of coefficients in the later time frame occurs primarily in relation to Command Climate and Supervisory Leadership rather than in relation to Peer Leadership.
- . Significant coefficients were concentrated in predictions of overall readiness, training, and equipment and supplies on hand. Except for the equipment and supplies measure, these readiness indicators seem to be those more readily impacted by the human organization.
- . The reason for the comparative infrequency of significance in the two latest periods (+5 & +6) is not so much that there is a drop in coefficient size (about as many absolutely rise as decline) as that the declining number of cases makes statistical significance increasingly difficult.

Table 2 presents similar data in relationship to the two measures of retention rate -- Total Reenlistment and First-Term Reenlistment. Here, as well, several observations seem warranted:

Table 1
 MULTIPLE REGRESSIONS: 14 HQMS INDEXES AS PREDICTORS OF
 OPERATIONAL READINESS FOR 13 TIME PERIODS

Readiness Measure	HQMS Index	R-6m	R-5m	R-4m	R-3m	R-2m	R-1m	R0	R+1m	R+2m	R+3m	R+4m	R+5m	R+6m
Overall Readiness	Command Climate	.16	.20	.20	.22	.18	.22	.24	.35*	.32*	.27	.30	.28	.36
	Sup. Leadership	.27	.19	.28	.27	.23	.22	.26	.35*	.40**	.40**	.33*	.37	.39
	Peer Leadership	.20	.27	.28	.26	.27	.22	.28	.34*	.30	.27	.26	.29	.28
	4 Dimensions	.22	.23	.22	.19	.18	.24	.26	.35*	.32*	.30	.29	.31	.33
Personnel Readiness	Command Climate	.23	.28	.27	.20	.28	.25	.26	.29	.31	.33*	.34*	.40*	.41
	Sup. Leadership	.15	.13	.08	.15	.18	.11	.15	.14	.23	.24	.24	.35	.39
	Peer Leadership	.10	.11	.12	.24	.27	.19	.13	.15	.17	.19	.21	.23	.28
	4 Dimensions	.03	.08	.11	.18	.24	.19	.23	.27	.28	.29	.29	.36	.35
Equipment Readiness	Command Climate	.21	.31	.33	.34*	.26	.17	.17	.22	.22	.20	.20	.11	.18
	Sup. Leadership	.21	.13	.21	.14	.12	.20	.23	.16	.21	.23	.31	.33	.44
	Peer Leadership	.18	.05	.26	.32	.26	.24	.23	.26	.30	.26	.25	.35	.43
	4 Dimensions	.27	.23*	.26	.32	.33*	.21	.24	.18	.23	.27	.23	.19	.25
Equipment & Supplies	Command Climate	.28	.41**	.31	.22	.14	.25	.32	.35*	.31	.23	.32	.41*	.31
	Sup. Leadership	.22	.29	.35*	.25	.18	.22	.27	.39**	.40**	.43**	.33	.31	.28
	Peer Leadership	.23	.41**	.30	.24	.14	.23	.27	.33	.31	.33	.33	.29	.22
	4 Dimensions	.32	.45	.33	.22	.18	.26	.32	.37*	.32	.26	.30	.32	.28
Training	Command Climate	.12	.14	.15	.14	.18	.20	.18	.18	.23	.24	.18	.29	.46
	Sup. Leadership	.11	.14	.13	.12	.13	.15	.18	.22	.15	.15	.13	.25	.49*
	Peer Leadership	.13	.06	.18	.14	.11	.13	.10	.08	.14	.15	.14	.18	.26
	4 Dimensions	.28	.34*	.26	.32	.36*	.36*	.33	.37*	.41**	.40**	.34*	.32	.40
Average (X) N		(81)	(86)	(84)	(85)	(85)	(85)	(86)	(84)	(84)	(84)	(85)	(60)	(46)

*p<.05

**p<.01

Table 2

MULTIPLE REGRESSIONS: 13 HRMS INDEXES AS PREDICTORS OF
REENLISTMENT RATE FOR 5 TIME PERIODS

Reenlistment Measure	HRMS Indexes	T-1 (-4m → -1m)	To (0m → +3m)	T+1 (+4m → +7m)	T+2 (+8m → +11m)	T+3 (+12m → +16m)
Total Reenlistment	Command Climate†	.27	.48**	.50**	.30*	.21
	Sup. Leadership	.39*	.43**	.41**	.45**	.24
	Peer Leadership	.46**	.43**	.46**	.51**	.57**
	4 Dimensions	.38*	.45**	.48**	.48**	.30
1st Term Reenlistment	Command Climate†	.23	.39**	.27**	.26	.09
	Sup. Leadership	.32	.44**	.23*	.29	.31
	Peer Leadership	.33	.41**	.30**	.29	.32
	4 Dimensions	.25	.27*	.27**	.30*	.32
Average (\bar{X}) N		(70)	(157)	(178)	(102)	(37)

† Command Climate contained only three, instead of four, indexes for these analyses. Decision Making Practices was not included.

*=p<.05

**=p<.01

- . There are approximately twelve times as many significant coefficients in the total table as one would expect by chance alone.
- . If we split the table into periods -1 and 0 (near past/contemporary) versus +1 through +3 (future), we find that:
 - . high proportions of significant coefficients occur in both time frames.
 - . high proportions of significant coefficients occur for all categories of predictors.
- . Significant coefficients are much more frequent and are stronger in relation to total reenlistment rate than in relation to first-term reenlistments alone.
- . For total reenlistment, significant coefficients in the later time frame are higher in magnitude than those in the earlier time frame.

These findings would appear to justify at least two conclusions that are instrumental to current value human resources accounting efforts in a Navy setting:

- (1) there are indeed significant multivariate relationships between HRMS predictors and both reenlistment and Readiness performance measures, and these relationships -- as in the case of the civilian data set -- tend to occur more frequently after the time of the survey than before.
- (2) There is clearly adequate evidence to merit further exploration of these measures for inclusion in any future performance trend indicator system that might be developed for Navy use.

Having stated the positive aspect, it seems appropriate to deal as well with several possible shortcomings. Some of these reflect the data set used in the analysis, rather than anything necessarily characteristic of the problem posed or the true relationships that exist. For example, there is some suggestion in these data that collapsing predictors into categorical scores (command climate as a single index, etc.), while made necessary to work with the number of available cases, results in the loss of valuable

variance. Second, there is some suggestion as well that the loss of cases in later periods may cost in frequency of significance as well as in loss of valuable variance.

These potential losses are illustrated in Tables 3 and 4, where mean zero-order and various multivariate coefficients are presented. In a "strong" period in the later time frame of readiness, for example, the size of the correlations go up from the low .20's for mean zero-order relationships, to the high .20's and .30's for multivariate relationships using four predictors. Were we to include all 13 or 14 indexes in a single prediction, however, a large gain would clearly be registered, with the relationships reaching the high .40's and .50's.

Given the restricted number of cases, the latter step raises a question of whether the observed gains simply result from characteristics unique to the present sample -- that the observed relationships would not extend to any other sample drawn from the same population. Some reassurance on this issue is provided from Tables 5 and 6, which present somewhat similar extractions for TVE and ABS in the civilian analyses reported earlier. There, as here, a substantial gain was registered as one moved from zero-order to multivariate relationships. In that set of instances, however, we may be reminded that the relationships did double cross-validate. While this proves nothing concerning the present set of Navy data, it is at least cause for some optimism that, given an adequate number of cases and an opportunity to double cross-validate, the relationships would hold up.

Table 3

RELATIONSHIPS OF HRMS INDEXES TO OVERALL READINESS:
ZERO-ORDER (r) AND MULTIVARIATE (R) CORRELATIONS

	R-6m	R-5m	R-4m	R-3m	R-2m	R-1m	Ro	R+1m	R+2m	R+3m	R+4m	R+5m	R+6m
Mean r, Climate	.01	-.09	-.20	-.18	-.17	-.17	-.21*	-.32*	-.28*	-.22*	-.25*	-.24*	-.27*
Mean r, Supervisory Leadership	-.03	-.15	-.20	-.16	-.15	-.18	-.22*	-.31*	-.25*	-.21*	-.20	-.21	-.24
Mean r, Peer Leadership	-.06	-.18	-.19	-.16	-.15	-.20	-.23*	-.31*	-.26*	-.22*	-.21*	-.24*	-.27*
r, Group Coordination	-.02	-.14	-.21*	-.18	-.16	-.16	-.22*	-.33*	-.29*	-.23*	-.23*	-.20	-.23
R, 4 Climate	.16	.20	.20	.22	.18	.22	.24	.35*	.32*	.27	.30	.28	.36
R, 4 Supervisory Leadership	.27	.19	.28	.27	.23	.22	.26	.35*	.40*	.40*	.33*	.37	.39
R, 4 Peer Leadership	.20	.27	.28	.26	.27	.22	.28	.34*	.30	.27	.26	.29	.28
R, 4 Dimensions	.22	.23	.22	.19	.18	.24	.26	.35*	.32*	.30	.29	.31	.33
R, 14 Indexes	.42	.44	.44	.43	.40	.37	.36	.43	.50	.52*	.45	.45	.57

Table 4
 RELATIONSHIPS OF HRMS INDEXES TO
 TOTAL REENLISTMENT RATE: ZERO-ORDER (r)
 AND MULTIVARIATE (R) CORRELATIONS

	T-1	To	T+1	T+2	T+3
Mean r , Climate	.32	.43	.44	.26	.03
Mean r , Supervisory Leadership	.27	.35	.36	.36	.19
Mean r , Peer Leadership	.29	.35	.39	.45	.12
r , Group Coordination	.34*	.41*	.39*	.40*	.13
R, 4 Climate	.27	.48*	.50*	.30*	.21
R, 4 Supervisory Leadership	.39*	.43*	.41*	.45*	.24
R, 4 Peer Leadership	.46*	.43*	.46*	.51*	.57*
R, 4 Dimensions	.38*	.45*	.48*	.48*	.30
R, 13 Indexes	.53	.53*	.54*	.56*	.65

Table 5

RELATIONSHIPS OF SOO INDEXES TO TOTAL VARIABLE EXPENSE:
ZERO-ORDER (r) AND MULTIVARIATE (R) CORRELATIONS

	Span 1 (8m → -1m)	Span 2 (0m → +8m)	Span 3 (+9m → +15m)	Span 4 (+16m → +24m)	Span 5 (+25m → +28m)
Mean r , Climate	-.12	-.05	.04	-.06	.16
Mean r , Supervisory Leadership	-.05	-.03	.01	-.07	.01
Mean r , Peer Leadership	-.02	.03	-.01	-.01	.06
Mean R -13 Indexes	.39	.31	.48	.42	.32

Table 6
 RELATIONSHIPS OF SOO INDEXES TO ABSENCE RATE:
 ZERO-ORDER (r) AND MULTIVARIATE (R) CORRELATIONS

	Span 1 (-6m → -1m)	Span 2 (0m → +4m)	Span 2a (+5m → +8m)	Span 3 (+9m → +18m)
Mean r, Climate	-.10	-.04	-.07	-.07
Mean r, Supervisory Leadership	-.13	-.07	.00	-.09
Mean r, Peer Leadership	-.11	-.07	-.12	-.10
Mean R-13 Indexes	.37	.27	.33	.46

Conclusions and an Illustration

These findings provide rather persuasive evidence that the base for a current value system of human resources accounting does, in fact, exist in Navy settings using Navy data. Not only are the basic requirements -- the four crucial assumptions -- met by accumulated evidence from earlier research, but also the present evidence suggests that multivariate relationships of respectable size exist for Navy units as well.

The potential value of such a system may be illustrated by a purely hypothetical set of values, plugged into a single set of calculations. Let us assume that, as a result of successful HRMS work, there were the following changes in HRMS dimension scores:

<u>Dimension</u>	<u>Change in Dimension Score</u>
Command Climate	+.25
Supervisory Leadership	+.50
Peer Leadership	+.75
Work Group Coordination	+1.00

These change scores would be multiplied by a set of regression weights. For illustration purposes, let us use the following figures:

<u>Dimension</u>	<u>Regression Weights for a Given Performance Period</u>
Command Climate	.2
Supervisory Leadership	.1
Peer Leadership	.2
Work Group Coordination	.15

Using these values, we would get $.25(.2) + .50(.1) + .75(.2) + 1.00(.15)$ or $+.85$ as the predicted change in reenlistment rate for a particular performance period. If the standard deviation for reenlistment rate across units were 10 percent, the predicted gain in total reenlistments would be $.85(.10)$ or 8.5 percent of those eligible. Of 100 eligibles, therefore, 8.5 more would reenlist than would otherwise be the case.

Carrying this illustration one step further, if the recruiting and training costs associated with each of the replacements were \$10,000, the savings generated from the improvement in the human organization would amount to $8.5(\$10,000)$ or \$85,000.

While the values assumed in this illustration are hypothetical, the bases and relationships are very realistic in terms of the findings of this present report. It is in such possibilities as that suggested in the illustration that the potential worth of future performance trend indicators lies. Actions and policies with potential costs and benefits in other, more conventionally tangible areas have possible human organization consequences as well. Without some system such as that demonstrated by the reports in this series, these consequences may well be overlooked and inappropriate courses set. The results of the present analysis suggest that a current value human resources accounting system is, in fact, feasible.

Summary

Previous reports in this series have demonstrated the feasibility of future performance trend indicators (FPTI) in civilian organizations. In this report, the basis has been laid for extending FPTI systems to the Navy. Using linear multiple regression as the analysis technique, the obtained relationships between HRMS indexes and both reenlistment and readiness performance measures are statistically significant in proportions for exceeding what would be expected by chance. There is clearly adequate evidence to merit further development of FPTI systems in the Navy.

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